

4.1.4 Land Cover and Administration

The present patterns of vegetation cover and use are shown on Figure 7. More than two-thirds of the basin is forested with conifers, mixed timber stands, and aspen groves. More than one-fifth of the basin is rangeland (in grasslands and shrubs), most of which is utilized for livestock operations. All of Meadows Valley and some locations in the lower basin are cropland and pasture. Nearly seven square miles along the eastern margin of the basin, mostly in the Hazard Creek drainage, are recovering from the effects of a large wildfire in 1994. Also in 1994, about 5.5 square miles burned in the Rapid River drainage during a prescribed fire (Shaw 2000). Local residents and natural resource managers state that significant portions of the forested lands are in “unnatural conditions” (in other words, timber stand conditions are prime for more catastrophic fires and watershed disturbances).

There is significant concern that sites previously occupied by fibrous woody vegetation species (trees and shrubs) will convert to tap-rooted invasive species such as yellow starthistle (Cornwell 2001). Yellow starthistle is a noxious weed spreading quickly in the main Salmon River canyons and uplands, and may invade the Little Salmon River basin. When this occurs, runoff impacts could be worsened or intensified when combined with rain-on-snow events.

Figure 8 shows the current land ownership distribution. The public owns 68 percent of the land in the Little Salmon River basin. Federal agencies manage about 241,152 acres of this land; state and local governments oversee 12,228 acres (state jurisdiction includes major highway rights-of-way). Private interests own 115,200 acres, clustered primarily along the Little Salmon River and at the southern end of the basin. The Nez Perce Tribe also owns a small parcel (less than five acres) near Rapid River. Human settlement occupies about three percent of the basin’s land.

Special management areas, shown on Figure 9, highlight some unique resources in the basin. These include a federally designated Wild and Scenic River, portions of the Hells Canyon National Recreation and Wilderness Areas, and a county historic park site. In addition, the Pony Creek Research Natural Area is located in the middle part of the basin, along a tributary to Boulder Creek. Research Natural Areas are tracts of land or water protected under the management of the U.S. Forest Service. The Pony Creek Research Natural Area is an important study area for factors affecting the distribution of vegetation. Its location in a transition area between northern and southern Idaho offers the opportunity to study a variety of vegetation and aquatic evolutionary characteristics in one location (U.S. Forest Service 1988).

4.1.5 Cultural Resources

Humans have occupied the Little Salmon River basin for between 8 and 11 centuries (Landeem and Pinkham 1999; U.S. Forest Service 1988). The Nez Perce and the Shoshone-Bannock Tribes claim to have occupied this area.

Tribal members grouped themselves in small semi-permanent villages, with groups of villages combining to form bands (Landeem and Pinkham 1999, Walker 1978). There was no permanent political body, but each band relied on the older males who came together as a council as needed. The tribes preferred local leadership to centralized authority (Walker 1978).

The Nez Perce Tribe considers salmon to be a part of their spiritual and cultural identity. The Indians Claims Commission concluded that the Indians economic cycle could be described as ten months of fishing and two months of berry picking, while hunting year-round. Each band had its own fishing places, which were respected by other bands (Landeem and Pinkham 1999).

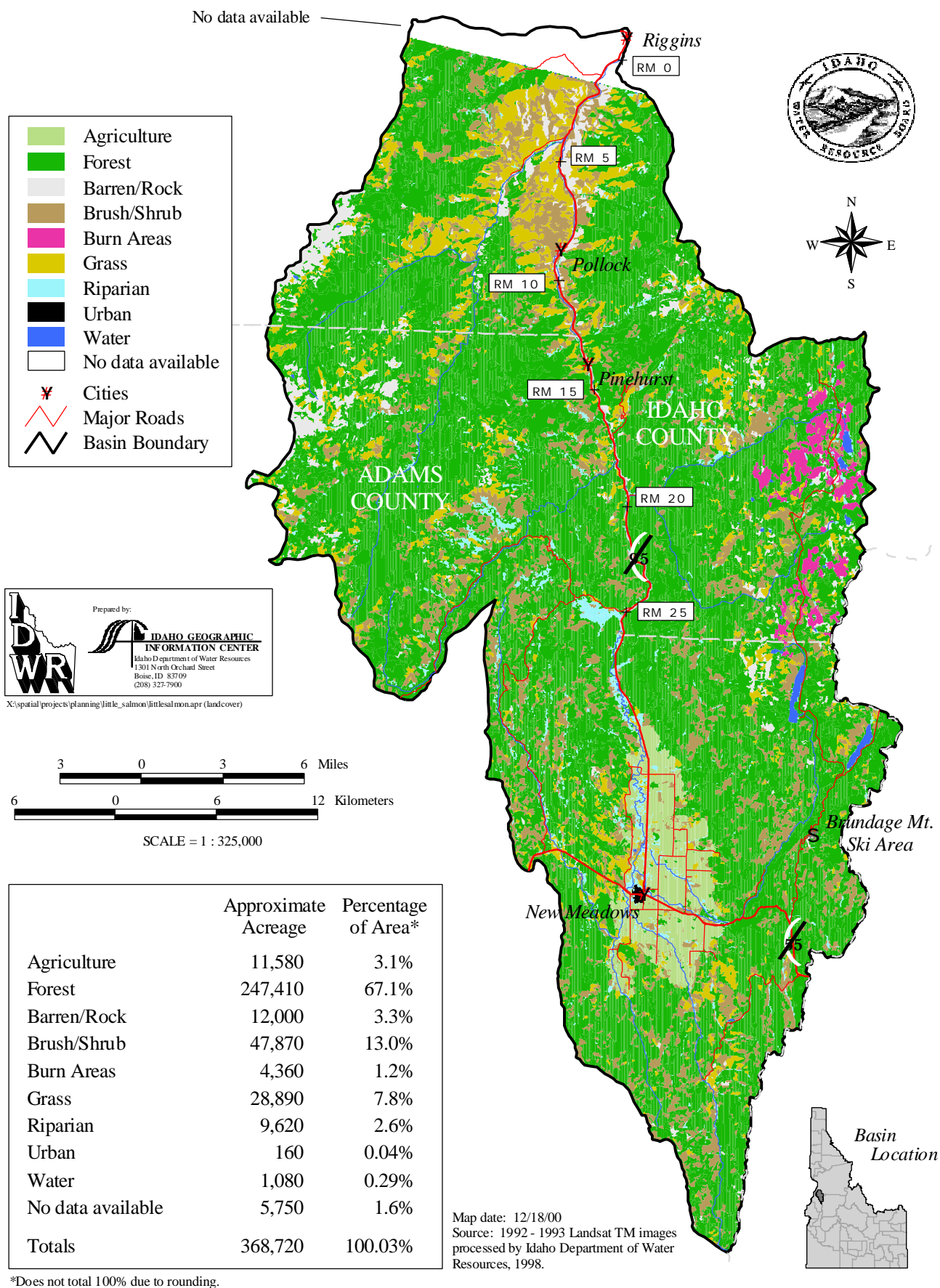
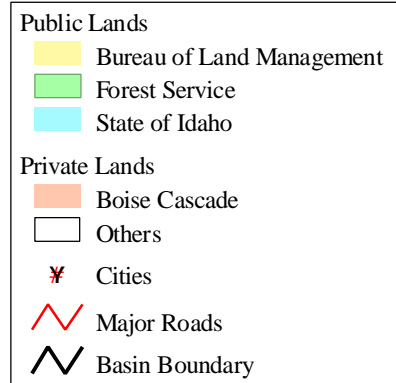


Figure 7. Land surface cover map of the Little Salmon River basin.

Land tracts less than 40 acres may be omitted due to map scale.



X:\spatial\projects\planning\little_salmon\littlesalmon.apr (ownership)

Map date: 12/18/00

Sources: 1) Boundary based on 1:100,000 hydrologic unit boundaries; 2) Ownership data from Bureau of Land Management and Idaho Department of Water Resources, 1997.



SCALE = 1 : 325,000

Land Ownership

	Approximate Acreage	Percentage of Area
Public Lands		
Bureau of Land Management	16,170	4%
Nez Perce National Forest	44,390	12%
Payette National Forest	180,400	49%
State of Idaho	13,410	4%
Private Lands		
Boise Cascade	48,000	13%
Other private	66,350	18%
Totals	368,720	100%

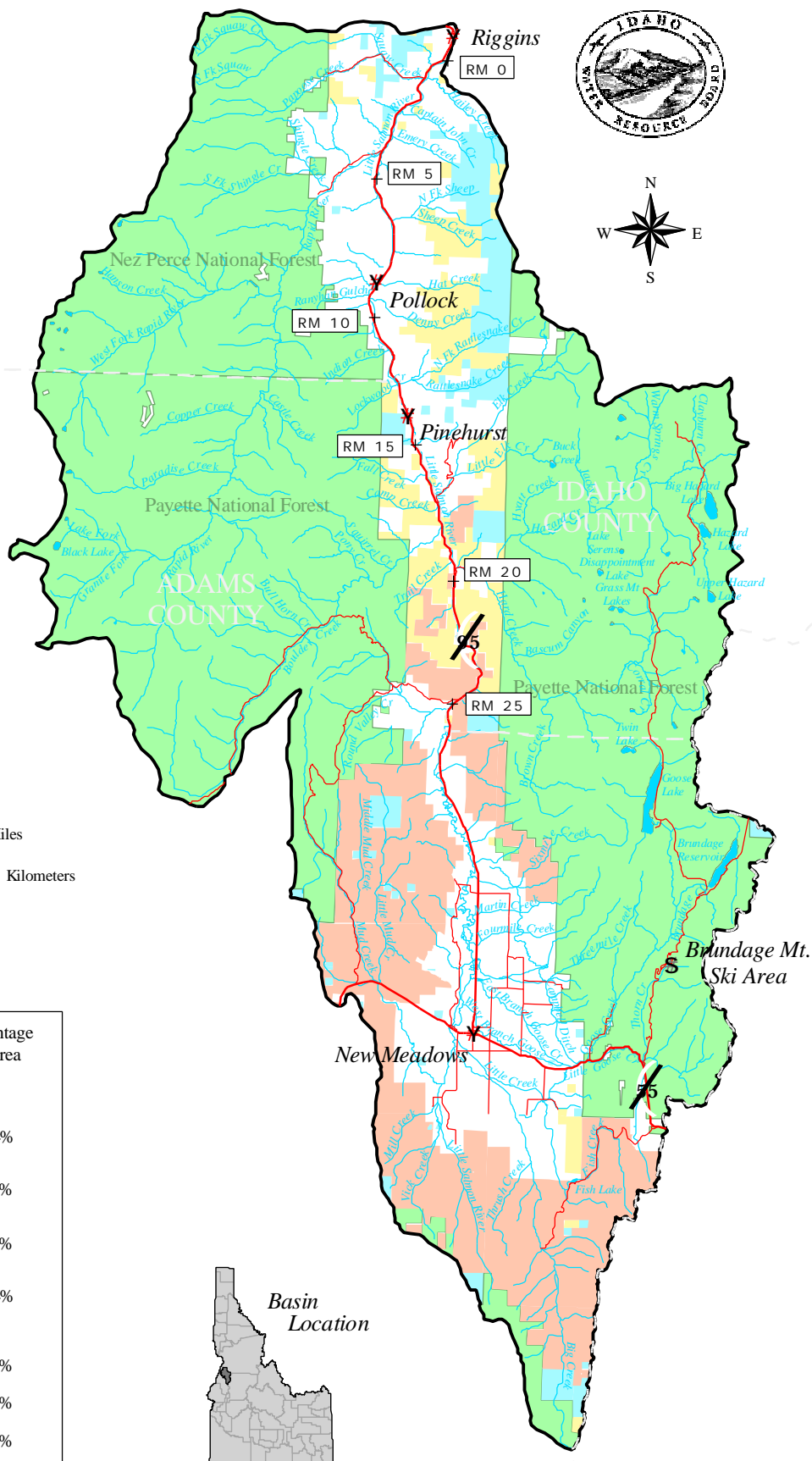


Figure 8. Land ownership and distribution in the Little Salmon River basin.

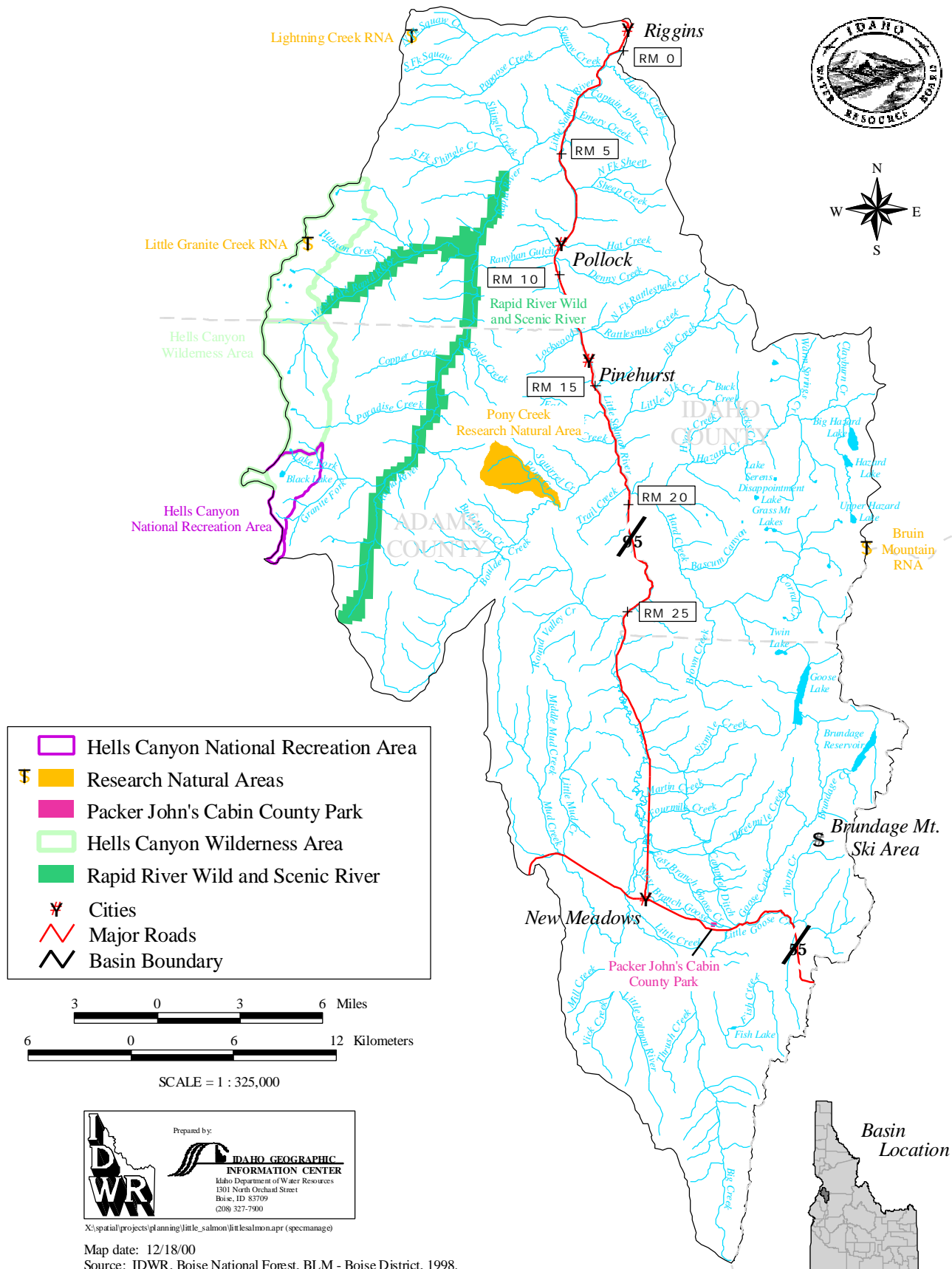


Figure 9. Special management areas for unique resources in the Little Salmon River basin.

Important changes came with the acquisition of horses in the early 18th century. Both the Nez Perce and the Shoshone-Bannock increased their areas of travel – the Nez Perce into the divide country, and the Shoshone-Bannock northward into the southwest Idaho mountains. Both of these tribes were wealthy because of the resource abundance of the central Idaho mountains and valleys and their use of horses for travel, hunting, and defense. Both tribes developed class societies based on wealth, which in turn was based on the ownership of horses (Walker 1978).

Changes came again with the influx of euro-americans in the 19th century. In 1836, Presbyterian missionaries introduced Christianity to the tribes, creating religious divides that influenced tribal government, treaty negotiations, and tribal and individual wealth (Landeon and Pinkham 1999). Conflicts with new settlers arose over access to lands and streams. The federal government became involved, and the tribes entered into treaty negotiations during the middle part of the 19th century. Tribal governmental systems changed; the U.S. government's demand for a single authority figure to act for the entire tribe was largely responsible for the creation of the head chief position (Walker 1978). The Nez Perce tribe ceded tribal lands in the Treaty of 1855. The Nez Perce reservation boundaries were further reduced by the 1863 Nez Perce Treaty and Cession Agreement in 1893.

In 1884, the Circle C Ranch, once one of the largest ranches in the country, was founded in the Meadows Valley by Charles Campbell. Other cattle and sheep ranches were developed; 67 ranches were reported in 1888 in the Little Salmon River basin (Eisensohn 1951). These new residents of the basin lived on the land. Support services were grouped into small towns and villages. The town of Meadows was supplanted by the city of New Meadows when railroad lines were built into the valley. The town of Riggins was established by ranchers, but timber extraction and mining also became important economic activities (Manser and Wilson 1983). Cattle and sheep ranchers

lived in permanent structures on lands outside of the towns. Rugged terrain and the need to tend to livestock and homes limited travel of the new settlers both within and outside of the basin. Newspapers of the time noted the passage of Indians through the basin as they made their way to hunting grounds in the basin (Eisensohn 1951). Indians – probably Nez Perce – fished and camped along the Little Salmon River in the spring and fall during the late 1800s (Manser and Wilson 1983).

Packer John's Cabin, a building located somewhere in Meadows Valley during the early 1860s, was used by travelers and early euro-american settlers of the area. A reconstructed version of the cabin is now a county park, although not at the cabin's original location (Defenbach 1984). A road was built to connect Riggins with Meadows Valley in the early 1900s. The first six cars traversed the road in 1916, and by the 1920s, the road was graveled (Manser and Wilson 1983).

Nez Perce tribal members continue to use the basin to exercise their treaty fishing and hunting rights. The Little Salmon River basin continues to be important to the Nez Perce for fishing, hunting, social, and religious activities.

The federal government recognizes important historical sites by listing them on the National Register. The National Register is maintained by the National Park Service and lists properties of national, state, and local archaeological, historic, or architectural significance. Several buildings in the Little Salmon River basin are listed on the National Historic Register: the Meadows schoolhouse, the Pacific and Northern Railroad depot, the Col. E.M. Heigho House (all in Meadows Valley), and the Aitken Barn south of Riggins.

4.1.6 Social and Economic Characteristics

Demand for water depends on the levels and patterns of demographic and economic activities in the Little Salmon River basin. In this section, estimates of population, housing, income, employment, and unemployment are used to describe the demographic and economic characteristics of the basin. Data for this section were obtained primarily from the Census of Population and Housing (U.S. Bureau of the Census 1960, 1970, 1980, 1990, 1995, and 2000). As of the date this basin plan was last edited (Sept. 2001), Year 2000 census statistics were not available, other than general population figures. Specific information regarding agriculture, timber, mining, and recreation was compiled by IDWR to meet the needs of this plan and requests made by various advisory group participants (refer to Appendix G).

The Little Salmon River basin lies within portions of Adams and Idaho Counties, and the area of the basin is considerably smaller than either one of the counties. Consequently, county level data is not necessarily representative of local demographic and economic conditions within the basin. A more accurate representation is potentially achieved by using census county divisions (CCDs) (Figure 10). These are areas defined and used by the U.S. Bureau of Census for collecting and presenting information at a sub-county level. Three CCDs cover parts of the Little Salmon River basin, but only two are substantially within the Little Salmon River basin and are used in this plan, and are: the New Meadows CCD, which covers 421.3 square miles in Adams County, and the Riggins CCD, which covers 1,221 square miles in Idaho County. Nevertheless, great care must be exercised when interpreting CCD-level information because there may be significant levels of economic activity inside the CCD, but outside of the Little Salmon River basin.

Population

According to the latest partial release of Year 2000 census information (dated March 2001) and depicted in Figure 11, only two counties in Idaho have seen declines in their numbers of residents (those being Butte and Shoshone Counties). Both Adams and Idaho Counties have grown slightly in the last ten years, as well as the New Meadows and Riggins CCDs (Figure 12). Contrary to this growth trend, the City of Riggins has seen about a seven percent drop in its population. The City of New Meadows, on the other hand, has stayed at nearly its same size since 1990, losing only one person. No recent census information is available for the towns of Meadows, Pinehurst, and Pollock at this time. About one-half of the basin's population lives in New Meadows, Pollock, or Riggins. The remaining residents occupy older ranch properties or newer rural subdivisions and ranchettes. The full time residential population of the Little Salmon River basin was estimated to be 2,695 in Year 2000.

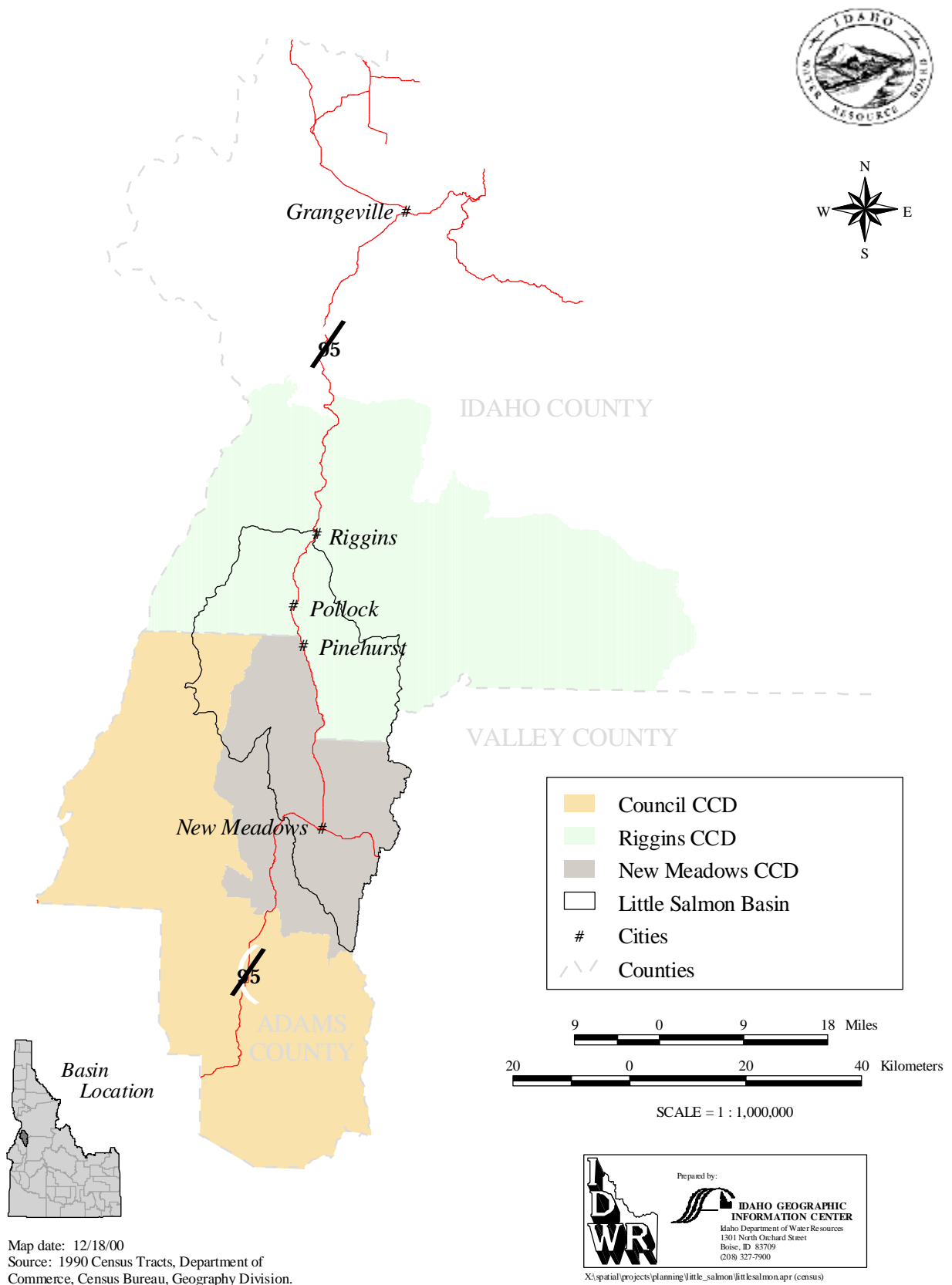


Figure 10. Census county divisions found in the Little Salmon River basin.

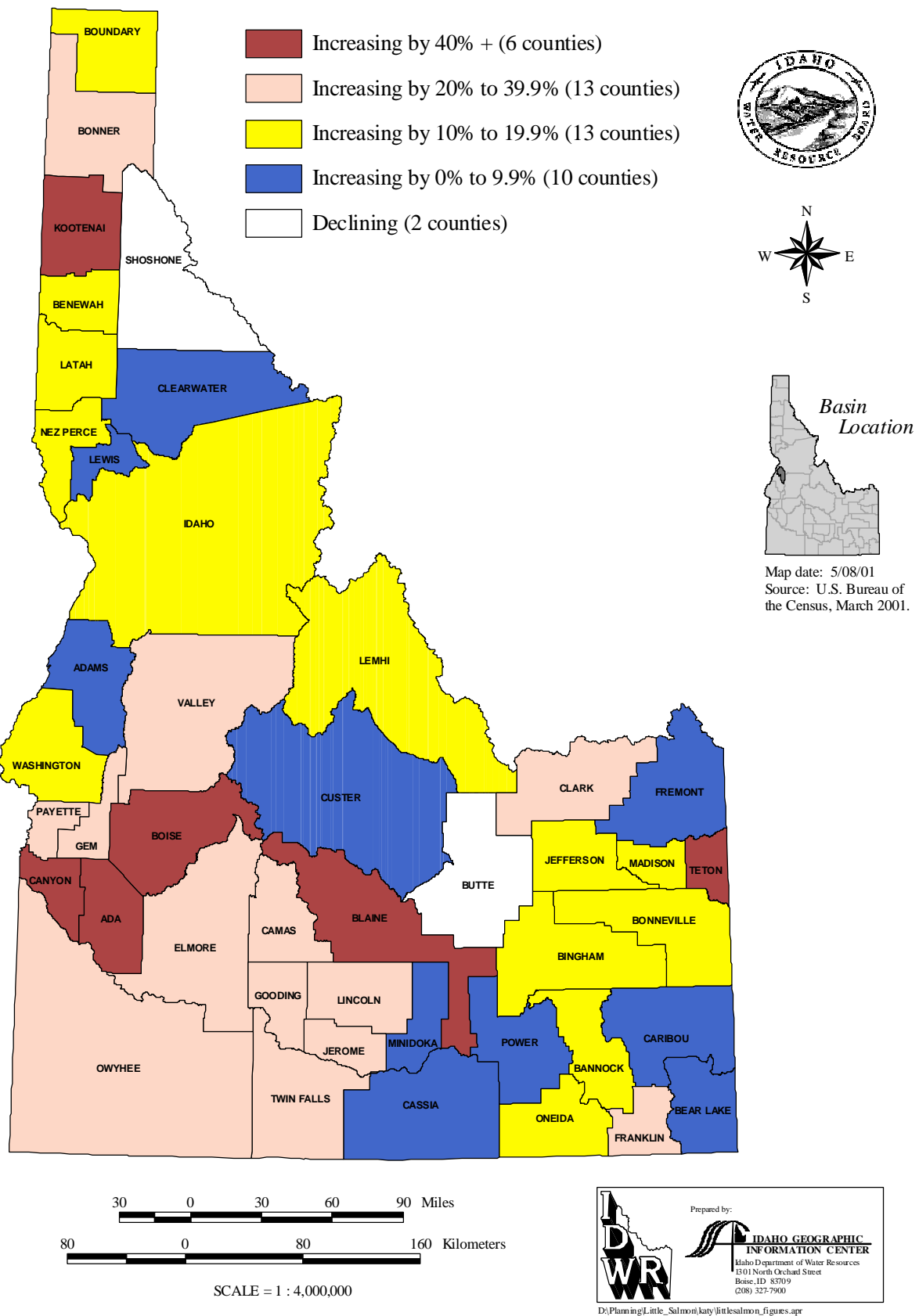


Figure 11. Percent change in population, 1990-2000 (Source: U.S. Bureau of the Census, March 2001).

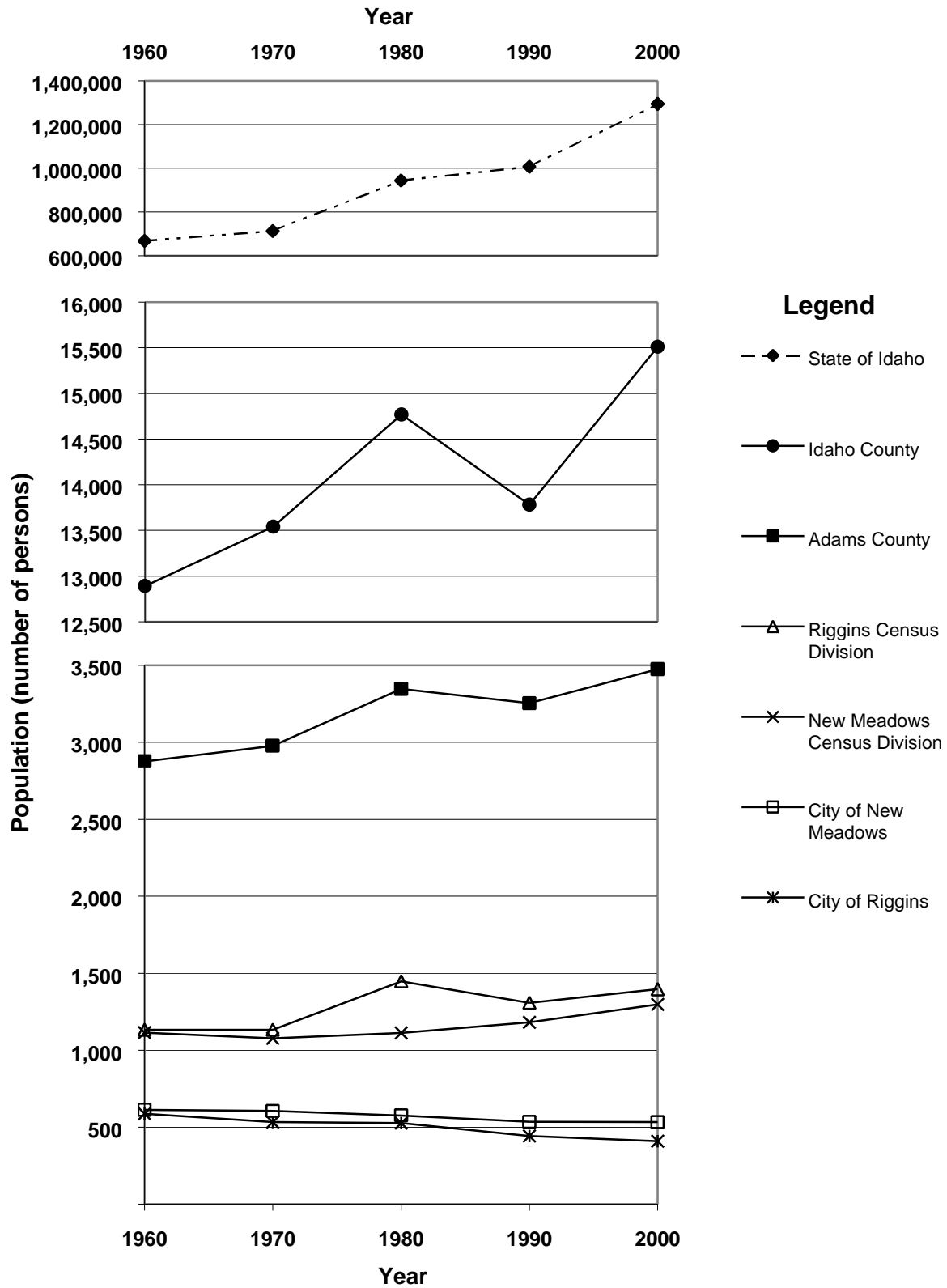


Figure 12. Population trends for selected locations in Idaho.

Age is another important aspect of the population of the basin. The basin's population is generally older than that of the state of Idaho. Figure 13 displays median age of the population in the New Meadows and Riggins CCDs, and the state. The increase in the median age of the basin's population can be explained by its decrease in the population of children under 18 years of age, and the increase in adults over 65 years of age.

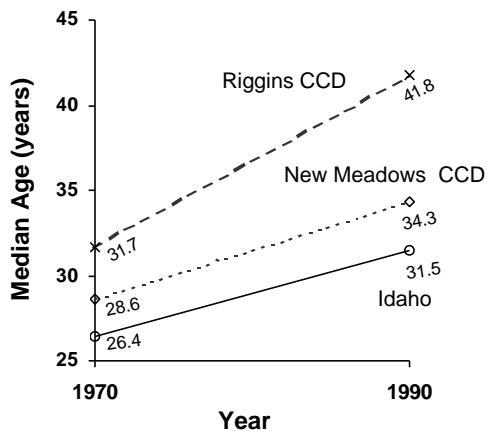


Figure 13. Median age of residents in the Riggins and New Meadows county divisions, and in Idaho.

Projections of future population are only available by county units, not by county census divisions. By Year 2025, according to Idaho Power Company projections, the populations of Adams and Idaho Counties would increase about 15 percent each from today's numbers to 4,340 and 17,020 respectively (Idaho Power Company 2001).

Characteristics of Households

Figure 14 illustrates the number of households occupied on a year-round basis, in the basin and in the state, during the years 1970, 1980, and 1990. The New Meadows and Riggins CCDs are shown on the left scale, and the state is on the right scale. Between 1970 and 1990, the number of households in New Meadows increased by 27 percent, and in Riggins the increase was 45 percent. In comparison, the population increased by 12.6 percent in the basin as a whole over the same period.

The relatively higher growth rate of households compared with the population reflects an increase in persons per household in the two CCDs. There was a decrease in persons per household in New Meadows and Riggins from 2.99 and 2.95, respectively, in 1970, to 2.58 and 2.35, respectively, in 1990.

Seasonal or occasional housing use (second homes) is an important characteristic of the basin and distinguishes it from the state as a whole. The Census of Housing estimated that seasonal housing added 121 units to the 457 year-round units in the New Meadows CCD in 1990. Similarly, seasonal housing added 151 units to the 529 year-round housing units in the Riggins CCD. These estimates put seasonal housing at between 17 and 19 percent of all housing in the Riggins and New Meadows CCDs. Those percentages are higher than the rest of the state, as illustrated in Figure 15. Seasonal housing on a statewide level was 6 percent in 1990. Furthermore, seasonal housing in the basin has remained almost constant from 1980 to 1990, whereas statewide seasonal housing fell from 8 to 6 percent, a decrease of 25 percent.

Income

Estimates of income and employment for the New Meadows and Riggins CCDs were obtained from the Census of Population and Housing for 1980 and 1990 (the Year 2000 Census income and employment statistics were unavailable as of the date this basin plan was written) (U.S. Bureau of the Census 1980, 1990). The residents of the New Meadows and Riggins CCDs had roughly the same per capita income in 1980 (Figure 16). However, between 1980 and 1990, per capita income almost doubled for New Meadows CCD residents, a growth rate mirrored at the state level. In contrast, Riggins CCD residents experienced an increase of only 50 percent over the same period.

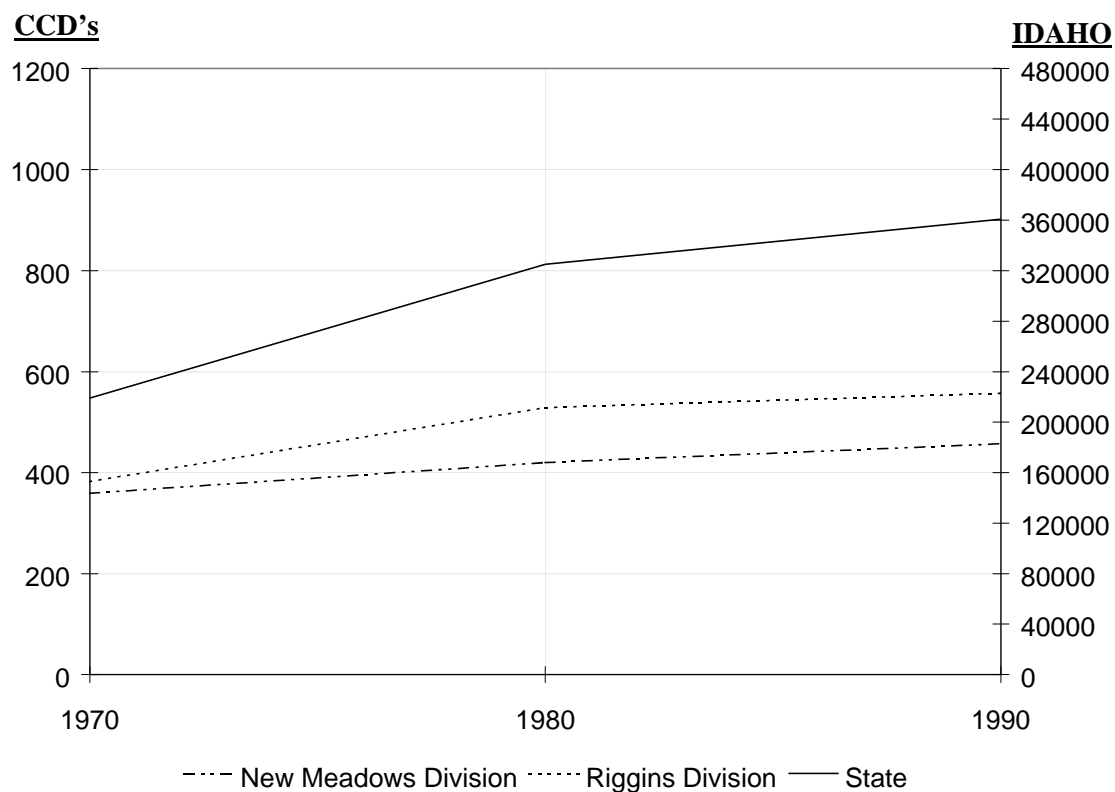


Figure 14. Number of households occupied on year-round basis in the Little Salmon River basin from 1970 to 1990.

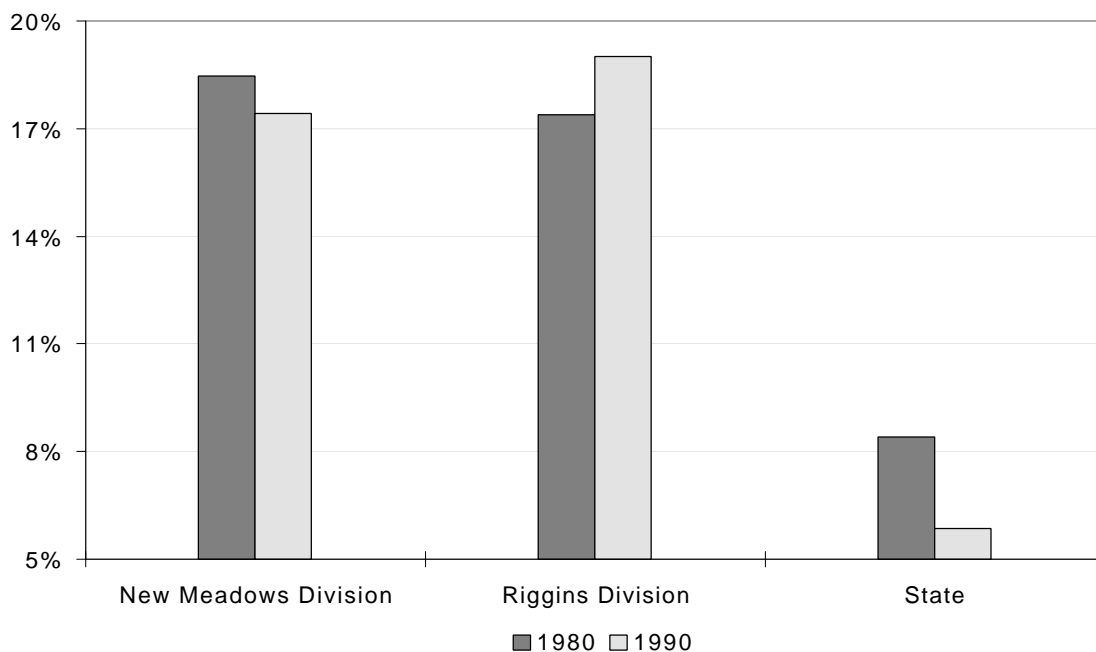


Figure 15. Percentage of seasonal housing in the Riggins and New Meadows census county divisions, and in Idaho (Source: U.S. Bureau of the Census 1980 and 1990).

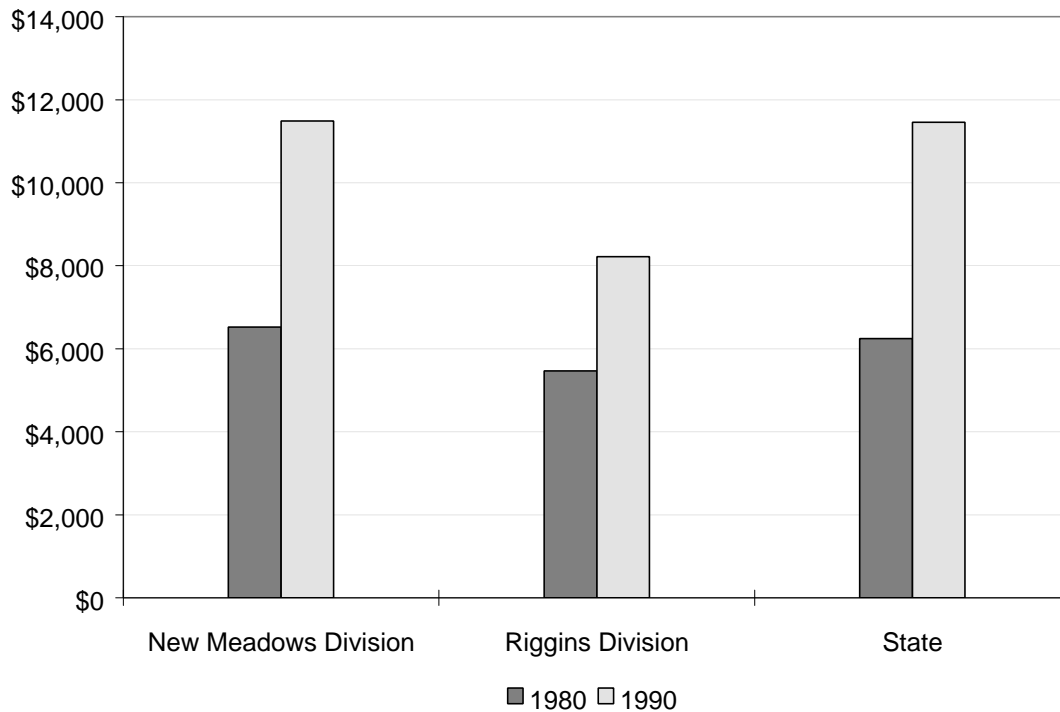


Figure 16. Per capita income in the Riggins and New Meadows census county divisions, and in Idaho (Source: U.S. Bureau of the Census 1980 and 1990).

To explain the income growth experienced by basin residents between 1980 and 1990, it is helpful to identify the primary sources of income as well as any changes that may have occurred during the period. Sources of income identified in the census included wages and salaries, self-employment, social security and interest, dividends and rents. In the New Meadows CCD, 71 percent of the income received in 1990 came from wage and salaries, 7 percent from social security, 7 percent from self employment and 12 percent from interest, dividends, and rents. In the Riggins CCD, a lower proportion of income came from wages and salaries (61 percent), a higher proportion from social security (13.4 percent) and self-employment (11 percent), and the same percentage from interest and dividend income (11 percent).

Employment

Figures 17, 18, 19, and 20 illustrate employment estimates. Industries are grouped into sectors corresponding to Standard Industrial Classification codes.

Major employers of basin residents are the agricultural sector (including forestry, fishing, and mining), service sectors (business, repair, personal, entertainment, recreational, and professional services), retail trade, and manufacturing. New Meadows and Riggins CCD residents are engaged predominately in agriculture. Primary activities are hay and cattle production. Some heavy equipment repair and forest product manufacturing are done within the CCD (but outside the Little Salmon River basin, as in the case of the Tamarack Sawmill). Nearby Brundage Mountain Ski Resort attracts visitors and has been expanding. Cattle ranches are scattered through the basin. Riggins is a popular fishing and rafting destination. It is also a traditional rest stop for travelers of U.S. Highway 95, Idaho's only major north-south road link.

Some Little Salmon River basin residents work outside the area. According to the census, 26 percent of New Meadows CCD residents and eight percent of Riggins CCD

residents worked outside their respective counties. Anecdotal evidence suggests that many New Meadows residents work just outside the basin at the Tamarack Sawmill and in nearby McCall, in Valley County. A small number of residents commute to Cascade, also in Valley County, and a few commute to Boise (Ada County).

Comparative and historical views of employment in the two CCDs are presented in Figures 17 and 18. About the same number of New Meadows and Riggins CCD residents were employed in agriculture in 1990. A greater number of New Meadows CCD residents were employed in retail and manufacturing, while more Riggins CCD residents were employed in service group employment. Between 1980 and 1990, total employment in the New Meadows CCD increased by 14 percent, whereas total employment in the Riggins CCD remained unchanged.

There were some important shifts in employment patterns from 1980 to 1990 in both CCDs. Retail and agriculture surpassed manufacturing as the largest employers of New Meadows residents. Services and public administration took over from manufacturing, construction, and transportation as the largest employers of Riggins residents. The increase in service employment in Riggins reflected a growth in recreation enterprises. Government employment increases were partly a result of the creation of the Hells Canyon National Recreation Area. Employment of Riggins residents in agriculture, forestry, mining, and fishing sectors fell slightly during the ten-year period.

Retail and services emerged as major sources of employment in the Little Salmon

River basin reflecting an increased demand for goods and services. Some of the demand comes from part-time or seasonal users of the basin, including spillover from the resort town of McCall. Demand is also fueled by others outside of the basin, who have incomes that have more than kept pace with the state's rising average wages. Additional demand comes from an increase in vehicle traffic passing through the area. Average daily travel at the intersection of routes State Highway 55 and U.S. 95 in New Meadows is estimated to have increased from 4,580 vehicles per day in 1980, to 7,080 vehicles per day in 1990. The rate of growth in vehicular traffic has since slowed; in 1997, 7,700 vehicles per day passed through New Meadows (Fuller 1999).

The employment profile of the basin does not match that of the state (Figures 19 and 20). Compared with the state, the basin has a proportionately larger agricultural sector (20 percent vs. 10 percent). The basin also has a larger proportion of recreation and entertainment services (9 percent vs. 4 percent) and smaller proportions of professional services (13 percent vs. 22 percent) and wholesale trade (1 percent vs. 5 percent).

An additional indicator of economic activity in the basin is the unemployment rate. While the area experienced a recession in the early and mid 1980s, Figure 21 shows that between 1980 and 1990 unemployment fell from 38 percent to 15 percent in the New Meadows CCD, and from 24 percent to 12 percent in the Riggins CCD. Yet in contrast with the state as whole, the unemployment rate in the basin remained high. Unemployment in the state during that same period fell from 7.9 to 6 percent.

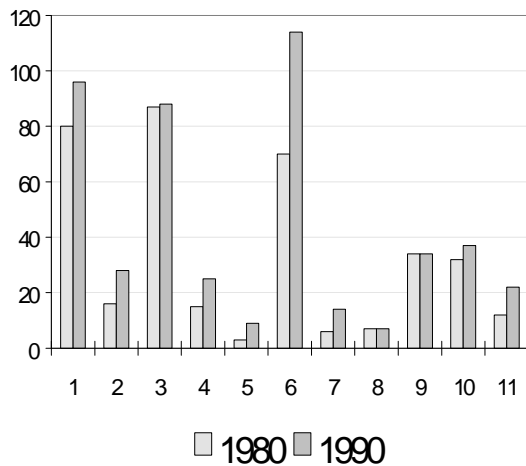


Figure 17. Number employed in New Meadows by census county division industry (Source U.S. Bureau of the Census 1980, 1990).

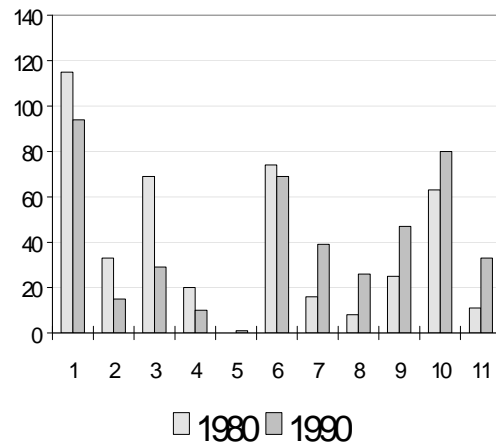


Figure 18. Number employed in Riggins by census county division industry (Source U.S. Bureau of the Census 1980, 1990).

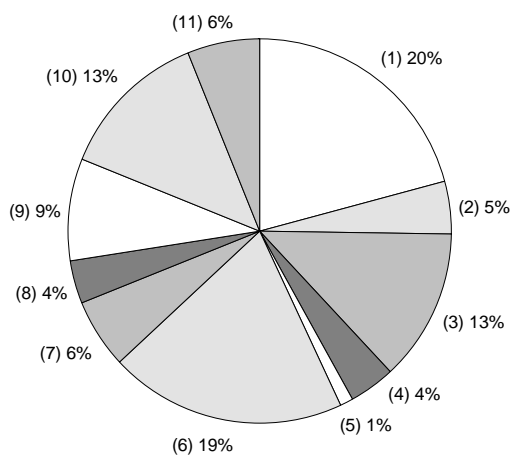
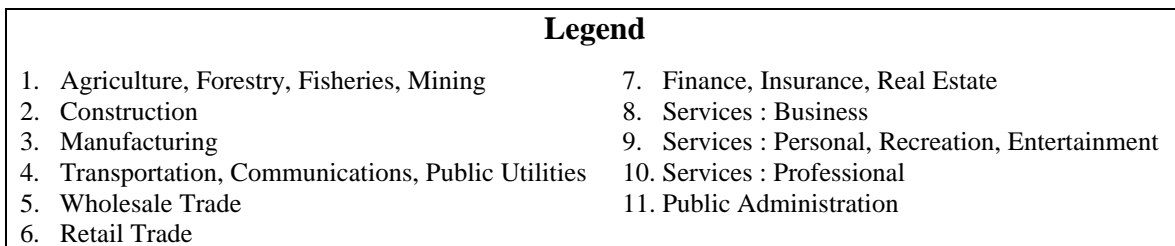


Figure 19. Percentage of employed in Little Salmon River basin by census county division industry (Source: U.S. Bureau of the Census 1990).

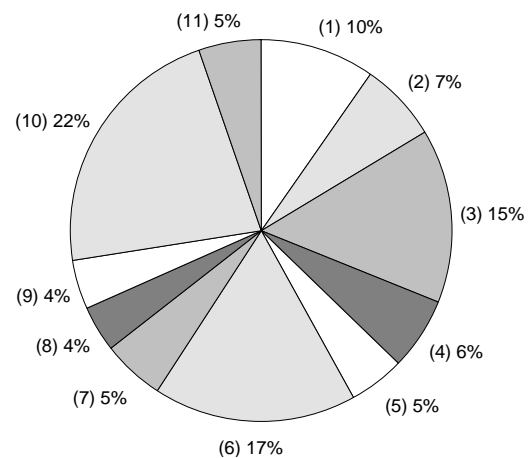


Figure 20. Percentage of employed in Idaho by census county division industry (Source: U.S. Bureau of the Census 1990).

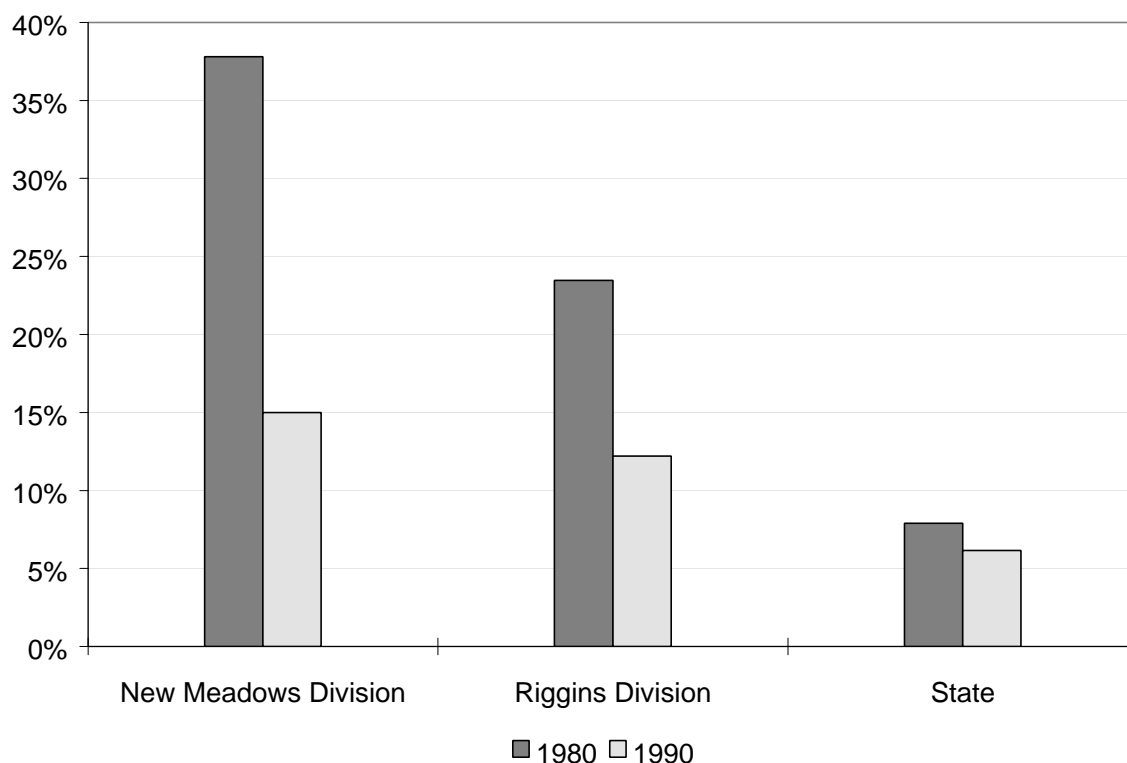


Figure 21. Unemployment rates in the Riggins and New Meadows census county divisions, and in Idaho (Source: Bureau of the Census 1980, 1990).

Old Economy vs. New Economy

There have been many debates regarding the economic values and worth of traditional employment sector jobs (such as in logging and ranching) when compared with river-based recreation sector jobs. In the last decade, float and power boating, salmon and steelhead fishing, and tourism have increased as part of the local economy. This trend is not unique to the Little Salmon River basin. Currently, tourism in Idaho ranks third in economic importance after agriculture and electronics manufacturing (with food processing #4, other manufacturing #5, timber/lumber #6, chemicals #7, and mining #8)(Idaho Dept. of Commerce 2001). Much attention has been directed to this issue, especially with the recent closures of area lumber mills and record salmon and steelhead returns in the Snake River system. One important message to learn from the data is that the basin's

economy is diversifying and growing. In the end, growth of tourism and recreation sector jobs adds to the local economy.

Because the Little Salmon River basin does not conform to common boundaries used for making detailed economic investigations, and given the difficulty of making accurate comparisons, no conclusions were made in this document pertaining to the “old” vs. “new” economy of the basin. IDWR attempted to make employment sector comparisons within the basin using several different data sources; the results were deemed inaccurate. However, IDWR did make economic estimates for the different sectors. Based on these estimates, the annual value to the basin from fishing and related recreation jobs is about equal to the economic value of crops in the basin. Appendix G provides details about fishing, agriculture, mining, and timber sectors. For

more information regarding relationships between logging and recreation sector employment, refer to Section 4.4.2.

4.1.7 Energy Supply and Conservation

The Idaho Power Company supplies electrical energy to the Little Salmon River basin. Most of this energy is produced by company-owned hydropower facilities at the Hells Canyon Complex on the Snake River. A power transmission line from Oxbow Dam generators crosses the upper end of the basin, south of New Meadows, en route to a substation at McCall. From this station, electricity is distributed throughout the area.

Hydropower projects are discussed in the *Water Resources* section of this chapter. Existing projects are described in *Water Allocation*. The discussion on proposed hydropower projects in the Little Salmon River basin is located in the *Water Resource Development* section of this chapter.

Wood remains a popular choice for heating because of the convenience of the basin's private and public forest properties. The low efficiency of wood as a fuel is offset by its low cost. It is not known if supply and distribution limitations constrain wood as a source to meet future energy needs in the basin. Wood fuel is used in a co-generation plant at the Tamarack sawmill, located near the Little Salmon River basin's southwestern boundary (outside the basin).

There is some use of propane for heating fuel. Propane is a byproduct of crude oil refining and natural gas processing. Consequently, its price is somewhat dependent on those processes. In addition, propane prices can exhibit price spikes that are greater in intensity than would be expected from normal supply and demand influences (Energy Information Administration n.d.). Price increases are often seen in the winter, as demand increases and refinement production remains constant. In addition, the residents of the Little Salmon River basin must cope with winter storms that cause interruptions in the

surface transportation system. These factors put propane users in a vulnerable position during the time of the year when supplies are most important.

The gasoline supply is adequate throughout the basin. Retail outlets are located in New Meadows and Riggins. As with other fuel sources, the basin remains vulnerable to stormy weather and interruptions in the surface transportation system. Natural gas, which is carried via pipelines to the end consumer, is not presently available in the Little Salmon River basin.

Conservation programs designed to increase efficiencies in energy use are expected to play major roles in meeting future energy requirements in the short-run (Idaho Power Company 2001). These efficiencies come about by encouraging less energy use in producing a given service while maintaining the desired amenity level.

The Energy Division of IDWR provides information, technical assistance, and financial support to promote cost-effective conservation and the use of energy-efficient resources. The Northwest Energy Code and locally-adopted building codes are examples of programs that support modern conservation standards for new building construction, and are usually administered by local governments. Existing buildings are eligible for energy conservation upgrading through several programs sponsored by state and federal agencies and the private utilities industries (Eklund 1997).

4.2 Water Resources

4.2.1 Water Supply

The term "water supply" refers to the amount of water in a particular area, in this case, the Little Salmon River basin. It is sometimes measured as precipitation or as stream flow. An accurate determination of the water supply in the Little Salmon River basin is difficult, as very little data on surface water flows have been collected. Stream flow measurements have been recorded for an extended duration at only

one location in the basin: the mouth of the Little Salmon River. Snow pack data are also collected at only one location: Brundage Reservoir. However, these data can be used to project stream flow conditions throughout the basin using established and accepted methodologies.

Surface Water

The Little Salmon River basin, compared with other hydrologic basins in Idaho, is atypical from a geomorphic and hydrologic perspective. Most often, the headwater portions of a basin have the highest elevation and correspondingly, the highest annual precipitation. The broad, relatively low relief of the Meadows Valley portion of the basin is not typical of a headwater area. The highest annual precipitation occurs mid-basin, along the eastern divide in the vicinity of Bruin Mountain and Hazard Lake, in Township 21N, Range 3E, and along the lower western divide in the upper Rapid River drainage, which is at the lower end of the basin (Ondrechen 1998).

Daily stream flow records are available for three locations in the basin: Little Salmon River at Riggins (1951– present), Mud Creek near Tamarack (1946-1959), and Boulder Creek near Tamarack (1938-1945). A comparison of the Little Salmon River and Mud Creek data indicate that the Mud Creek gage peaks much earlier than the Little Salmon River gage. Boulder Creek, a smaller watershed at a much higher elevation than Mud Creek, has a date of

peak flow much closer to the Little Salmon River gage (Ondrechen 1998).

The User Guide for Idaho Hydrologic Maps (Warnick et al. 1981) provides rough estimates of average annual runoff at selected ungaged sites based on estimated average annual precipitation and runoff coefficients calculated for gaged sites. Estimated values are available for three sub-basins in the Little Salmon basin, as shown in Table 3. According to these estimates, 32 percent of the annual runoff from the basin originates above Round Valley Creek. The Hazard Creek drainage, which is downstream of Round Valley Creek, contributes 19 percent of the total flow of the Little Salmon River. The Rapid River, which empties into the Little Salmon River at the lower end of the drainage in Township 24N, Range 1 E, Section 32, contributes 23 percent of the drainage's total flow.

The estimated volumes and rates of flow do not include a temporal component. Typically, gradually warming temperatures in the spring create high runoff flows that then taper through the spring and summer to low flows in the winter. This pattern can be altered by winter rain events, as occurred in January of 1997, resulting in high stream flows. Or, a cool spring will maintain snowpack later into the year, which may result in heavy stream flows when temperatures increase sharply as summer arrives.

Table 3. Estimated average annual runoff.

Location	Drainage Area (mi ²)	Average Annual Precipitation (in.)	Estimated Average Annual Runoff (cfs) ¹
Little Salmon above Round Valley Creek	188	32.1	244
Rapid River (mouth)	126	32.0	172
Hazard Creek (mouth)	86	33.6	144
Little Salmon at Riggins	584	31.1	762 ²

¹Cubic feet per second

²Observed average annual runoff (1951-1997) is 792 cfs. Source: Warnick et al. 1981.

The temporal aspect of runoff affects the use of storage facilities at Granite Twin Lake, Goose Lake, and Brundage Reservoir. These reservoirs are not large enough to contain all of the high flows in the spring. In the summer, usually by early July, water is released from the reservoirs to meet downstream water rights. Water right owners divert water from the stream system in accordance with their water rights. As a result, stream flow in the Little Salmon River between Goose Creek and the tributaries in the canyon area becomes reduced as the summer progresses.

IDWR designates standard irrigation seasons of use for the different areas of the state. The standards are based on the water requirements of alfalfa, and take into account climate and elevation data (Peppersack 1999). For most of the lower elevations in the Little Salmon River basin, the irrigation season is from April 1 to October 31 of each year. A portion of the downstream end of the basin has a longer season from February 15 to November 20.

Based on IDWR's irrigation seasons and other run-off calculations (Warnick et al. 1981), the basin produces an average volume of 322,875 acre-feet over the course of the irrigation seasons. Two-thirds of this water originates downstream of Round Valley Creek.

Ground Water

Data for ground water systems in the Little Salmon River are limited. Development has been almost exclusively for domestic and municipal uses. Four areas in the basin (New Meadows, Pinehurst, Pollock, and Riggins) have developed ground water, as described below.

New Meadows is situated on an alluvial basin (see *Geology* and *Soils* sections). Based on well drilling reports submitted to the IDWR, basalts are interlayered with clays, sands, gravels, and boulders, as one might expect in an alluvial environment. At lower depths, basalt becomes the dominant rock. Well depths range from approximately 40 feet (domestic) to over 600 feet

(municipal). Ground water can be found at depths less than 20 feet to as deep as 550 feet. Available data suggest connectivity between deep and shallow ground water; both are part of a single aquifer without a consistent intervening confining layer. Well yields range from 15 to 20 gallons per minute for domestic wells, to over 400 gallons per minute for municipal wells. Recharge to the aquifer comes from the Little Salmon River, Big Creek, Little Creek, and the West Branch of Goose Creek.

The Pinehurst and Pollock areas display similar ground water hydraulic characteristics. Both areas are underlain by a shallow alluvial aquifer under the valley floor. Based on well drillers' reports, the main aquifer consists of course-grained alluvium ranging from a few feet to over 30 feet in thickness. Well yields range from 10 to 30 gallons per minute. Bedrock lies 30 to 60 feet below the surface. Ground water in the hard rock beneath the alluvium, and in the surrounding mountains, is found at variable depths associated with fracture zones. The bedrock in the Pollock area appears to be more fractured than near Pinehurst, resulting in slightly higher yields. Yields range from two to 15 gallons per minute in both areas.

Recharge to the alluvial aquifer is mostly from the Little Salmon River with minor amounts of water from tributaries. Recharge to the ground water in the hard rock is from surrounding creeks and streams and associated precipitation.

Data for the Riggins area are more limited than for the rest of the basin. There are only four well drillers' reports on file with the IDWR. Although no well logs are available for the two municipal wells that serve the city of Riggins, it has been reported that each well produces 300 to 350 gallons per minute. It can be assumed that the hydrogeology in Riggins is similar to the Pinehurst and Pollock areas – a shallow alluvial aquifer underlain by hard rock. Recharge is principally from the Little

Salmon and Salmon Rivers (Bendixsen 2000).

Geothermal Water

There are a number of geothermal springs and wells in the Little Salmon River basin. Most of them are located along the Little Salmon River corridor in the Meadows Valley.

The IDWR investigated the geothermal resources of the state and issued a report in 1980. No geothermal wells or springs were found in the Idaho County portion of the Little Salmon River basin, but several were located and measured in the Adams County portion. Krigbaum Hot Springs, located east of the city of New Meadows, flows from a northeast trending fault in Cretaceous granitic rocks near Miocene basalt. Two separate vents were measured at 567.75 gallons per minute, at temperatures of 104°F and 107.6°F. IDWR estimates subsurface temperatures of 166.8°F and 204.8°F, respectively (Mitchell et al. 1980). A geothermal well at Zims, a commercial establishment next to the Little Salmon River north of New Meadows, was measured at 166°F, and produced approximately 36 gallons per minute (Idaho Department of Water Resources 2000a).

The IDWR has measured other geothermal springs and wells located along the Little Salmon River corridor north of New Meadows. Temperatures range from 78.8°F to 166.8°F, with discharges of 5 to 10 gallons per minute. Some wells and springs have not been measured by IDWR, but owners report temperatures up to 138°F and flows of nine to 378 gallons per minute (Idaho Department of Water Resources 2000a).

4.2.2 Water Allocation and Use

The constitution and statutes of the state of Idaho declare all waters to be property of the state. This includes streams and rivers flowing in natural channels, springs and lakes, and all ground waters. A water right represents permission from the state to put its waters to a beneficial use. Water rights describe the source of water, a priority date,

the amount of water to be used, what the water is to be used for, and where and when the water will be used. The IDWR administers water rights in Idaho based upon the Doctrine of Prior Appropriation, (i.e., first in time is first in right.) See Chapter 4.3.1 for information regarding moratorium orders issued by the director of IDWR.

Court Decrees and the Snake River Basin Adjudication

There have been eight court decrees of water rights in the Little Salmon River basin prior to the Snake River Basin Adjudication (SRBA). The decrees are listed in Appendix D. Water right decrees sometimes require a watermaster to deliver the rights as described in the decree. One watermaster serves both Big Creek (District 78A) and Goose Creek (78C) in the southeastern portion of the basin at this time.

A verification of all water rights in the Snake River Basin, for both surface and ground waters, is being conducted for the Snake River Basin Adjudication. The IDWR is responsible for the verification process, including field examinations. A final determination of each claim is the responsibility of the SRBA Court, located in Twin Falls.

The SRBA verification of claims in the Little Salmon River basin for all uses other than *de minimus* domestic and/or stock water is scheduled for 2004, with IDWR's recommendations to be submitted to the court in early 2005 (Warntjes 1998, Kelly 2000). Included in this verification will be claims on Granite Twin Lakes, Goose Lake Reservoir, and Brundage Reservoir, all important water storage facilities in the upper end of the basin.

Three Indian tribes, the Nez Perce, the Shoshone-Bannock, and the Shoshone-Paiute, along with the United States Bureau of Indian Affairs, have filed claims for instream flows throughout the basin. The validity of these claims will be determined through negotiated settlements between the Tribes and the State of Idaho, or by legislature, or the SRBA court.

Other filings in the SRBA include claims for rights to flood waters that have not been previously recorded with the IDWR. The SRBA court will determine the validity and extent of these claims.

Volume and Season of Use

Water stored in reservoirs may be used to supplement water from a flowing stream (natural flow rights), depending on valid water rights, water availability, and other factors. Generally, irrigation water from storage facilities is not used until later in the season when stream flows have decreased. Use from a particular source may depend on weather conditions such as temperature and precipitation, or on traditional practices. It is difficult to determine with certainty how much water is diverted from specific tributaries because of these variable irrigation patterns. Inadequacy or lack of measuring devices may compound the problem, especially in drainages where there is no organized water district and watermaster to properly measure diversions and manage water use. In the Little Salmon River basin there are only two organized water districts with watermasters; Big Creek (78-A), and Goose Creek (78-C). However, it is possible to estimate water use based on estimated irrigated acres, and water use allowed by IDWR.

The IDWR designates standard irrigation seasons of use for different areas of the state. The standards are based on the most water-consumptive crop in the area, and take into account climate and elevation data (Peppersack 1999). For the majority of the Little Salmon River basin agriculture lands, the irrigation season is from April 1 to October 31 of each year. The lower elevation portion of the basin has a longer season, from February 15 to November 30.

In addition to designating seasons of use, IDWR also calculates the volume of water necessary for diversion to grow crops over the course of a specific irrigation season. Some of this water, between 25 and 33 percent, is assumed to return to the system, either through percolation into the ground water or surface runoff.

The estimated field headgate requirement for diversion of water in the upper basin (including Round Valley Creek) is three acre-feet of water per acre during the irrigation season. For the lower basin, four acre-feet per acre is required during the irrigation season. Using this field headgate requirement, the estimated 15,100 acres irrigated in the upper basin would need 45,300 acre-feet per year. For the estimated 1,300 acres irrigated in the lower basin, 5,200 acre-feet of water would be needed, for a total of about 50,500 acre-feet per year in the basin. The actual water use is unknown since it is based on all existing water rights and the annual use of each right. The actual water use cannot be determined until the formation of water districts with watermasters throughout the basin or the completion of the basin adjudication process (SRBA).

4.2.3 Irrigation

Surface Water

Nearly all irrigation in the Little Salmon River basin is accomplished with the use of surface water in gravity flood or gated pipe systems. These systems operate by means of a physical barrier in the stream that directs water into a canal or ditch. Smaller ditches or laterals run from the main ditch to specific properties, where even smaller ditches may diverge. Soil, rock, or canvas dams, or small headgates divert the water into gated pipes or ditches. The water is then directed out over the fields. Water floods over the ground to irrigate the crop. Excess water percolates down into the ground or runs down-gradient over the ground to a drainage ditch or natural drainage way.

Upper Basin

About 92 percent of the irrigated acres in the Little Salmon River basin are located upstream of the confluence of Round Valley Creek and Little Salmon River. The majority of these 18,500 acres are irrigated with water from Twin Granite Reservoir, Goose Lake Reservoir, and Brundage Reservoir (Idaho Department of Water Resources 1998). These three storage facilities are in

the headwaters of Goose Creek and its tributary, Brundage Creek.

Goose Lake Reservoir is the oldest of the three facilities. It was originally constructed in 1919 to irrigate 4,800 acres in Meadows Valley. The height of the dam was increased in 1924, in 1931-32, and in 1951. The reservoir's current capacity is 6,550 acre-feet, with a surface area of 386 acres; its catchment area is about 8.3 square miles (Goose Lake Dam and Reservoir Operation Plan 1996). The earth embankment dam is now 27 feet high, with a hydraulic height of 21 feet, 1,250 feet long, and is classified as a large size, high-risk dam by the IDWR, because of its location above residential development in the valley. There are no instrumentation or monitoring devices on the dam. Visual inspections are conducted weekly when the reservoir is filling in the spring, and every other day during the irrigation season. Goose Lake Reservoir is filled during spring runoff, and is usually at capacity by late May or early June. Releases usually start by the end of June to meet irrigation water rights in the valley. The maximum discharge at full pool is 80 cubic feet per second (Goose Lake Dam and Reservoir Operation Plan 1996).

Twin Granite Reservoir is located about two miles upstream of Goose Lake Reservoir. Twin Granite is an earthen dam, originally constructed in 1920 to store water for irrigation purposes. In 1958, all of the previous cribbing was removed and a cut-off trench dug down to bedrock. The dam is now 20 feet high, with a crest length of 620 feet plus an additional 160-foot dike. Draining 0.6 square miles, the reservoir has a 600 acre-foot capacity. There is no written operation plan for the reservoir. The dam outlet is opened in the fall, and water is not stored until spring run-off is well underway. Water is released after spring run-off, when space is available in Goose Lake Reservoir. The maximum discharge is 19 cubic feet per second (Dam Summary Sheet 1999a).

Brundage Reservoir was originally built as a Work Progress Administration project in 1936. The earth embankment dam was

replaced and enlarged in 1987 as a cost-sharing project (sponsored by the Adams Soil Conservation District) with the local users, the Idaho Water Resource Board, and the Soil Conservation Service. The dam is now 92 feet long and 63 feet high, with a hydraulic height of 56.5 feet. Located at 6,238 feet above mean sea level, it has a capacity of 7,330 acre-feet and a surface area of 270 acres. The reservoir usually fills sometime between late May and early July. Releases of water start in late June and continue through early September. Per an agreement worked out between Brundage Water Users Association and the U.S. Forest Service in May 1985, the U.S. Forest Service now holds a 500 acre-foot water right in Brundage Reservoir, with the designated beneficial use being recreation storage. The water is maintained by the Forest Service as a conservation pool year-around for fish and wildlife habitat.

At full pool, the maximum release is 291 cubic feet per second (Dam Summary sheet 1999b). The IDWR has classified Brundage Dam as a large size, high-risk dam and has an automated, piezometric seepage monitoring system. The embankment, drains, and spillway are also inspected every other day during the irrigation season. While filling in the spring time, the dam is inspected weekly. There is also a Natural Resources Conservation Service SNOTEL site adjacent to the reservoir that is used for monitoring the water content of snow and run-off conditions. In addition, the dam owners must complete an annual written inspection report. The Idaho Department of Water Resources and the U.S. Forest Service inspect the dam bi-annually (Brundage Dam and Reservoir Operation Plan 1996).

Lower Basin

About eight percent of the irrigated acres in the Little Salmon River basin are located downstream of the confluence of Round Valley Creek. Water right records on file with the IDWR indicate that approximately 1,300 acres of irrigation are from various surface water sources.